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60°C, 61°C, 62°C, 63°C, 64°C, 65°C, 66°C, 67°C, 68°C, 69°C, 70°C, 71°C, 72°C, 73°C, 74°C, 75°C, 76°C, 77°C, 78°C, 79°C, 80°C] 400°C, 410°C, 420°C, 430°C, 440°C, 450°C, 460°C, 470°C, 480°C, 490°C, 500°C, 510°C, 520°C, 530°C, 540°C, 550°C, 560°C, 570°C, 580°C, 590°C, 600°C, 610°C, 620°C, 630°C, 640°C, 650°C, 660°C, 670°C, 680°C, 690°C, 700°C, 710°C, 720°C, 730°C, 740°C, 750°C, 760°C, 770°C, 780°C, 790°C, 800°C or higher.

REMARKS

The application and the material cited to date have been carefully reviewed along with Examiner's remarks in the Office action. After this review, Applicant is convinced that his claimed composition and articles are novel and patentable. Applicant strongly believes that his application embodies a significant discovery, that the claims define the invention in a clear and definite manner, and that all of the amended claims are allowable.

The rejection under 35 USC §112 second paragraph should be withdrawn

Claims 1, 2, 3, 13, and 14 have been amended to correct typographical errors pointed out in the Office Action. The claims as amended conforms to the requirements of 35 USC 112, second paragraph.

The rejection under 35 USC §102 or under 35 USC 103(a) as obvious over '708 and '468 should be withdrawn

The present claims 1-14 of the invention are not the same, are patentably distinguishable, and non-obvious in view of Applicant's patents '708 and '468 together or separately and the rejections under 35 USC §102(b) as anticipated by or, in the alternative, under 35 USC 103(a) should be withdrawn.

The '468 patent is a parent of '708 and the great grand parent (four times removed) of U.S. Patent #5,633,286 which in turn is the great grand parent (three times removed) of the present application (09/274,498). The subject matter of '468 and '708 are disclosed and contained in the present application, as well as, in all the parents and great grant parent cases without break. The '468 and '708 patents are Applicant's own work.

The present claimed invention is patentably distinguishable over '468 and '708 because the patented claimed invention '468 and '708 are not for the same invention as the instant claims 1-14 of the present application. The instant claims 1-14 are not anticipated by '468 or '708. The '468 and '708 patent does

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not teach any aspect of the claimed invention, not explicitly and not impliedly. Moreover, the subject matter of claims 1-14 of the present application is not directly taught and not inherently taught in '468 or '708.

At page 3, paragraph 5 of the Office Action, it states that

"Each of the references ['468 and '708] disclose gelatinous elastomer compositions comprising resins based on polyethylene and polystyrene and additionally containing a plasticizer."

This statement is not correct. There are no polyethylene and polystyrene based resins in any of the cited '468 and '708 patents. The Office action gives no column numbers and no line numbers as to where "polyethylene and polystyrene resins" are to be found in the '468 and '708 patents or the present application. As use in the Office statement, "resins based on polyethylene and polystyrene" has no meaning with respect to the nomenclature of the '468 and '708 patents and the present application. Consequently, by the use of the words "polyethylene and polystyrene", the connecting word "and" of the Official statement is taken to mean the representational nomenclature use by Applicant in '468, '708 and the present application where "and" stands for the segment "-" forming the copolymer (polyethylene-polystyrene) which corresponds to the copolymer poly(ethylene-styrene) or written as the copolymer (ethylene-styrene). If "polyethylene and polystyrene" as use in the Official statement is not meant to denote the copolymer (ethylene-styrene) or polyethylene-polystyrene, then the statement is meaningless and is not understood in the contexts of the language convention of the '468 and '708 patents and the present application and their claims. It is uncertain why the Office use the word resins because the components of the gels are polymers and plasticizers, more specifically, copolymers and plasticizers. In any event, the basic assumption is made that by "resins", the Official statement meant polymers and "resins based on polyethylene and polystyrene" is assumed to mean polymers of polyethylene and polystyrene. Since "polyethylene and polystyrene" is a copolymer by convention of the language of the specification, then "polyethylene and polystyrene" means the copolymer (ethylene-styrene). This copolymer is not found in '468 or '708; both do not teach or show the poly(ethylene-styrene) copolymer anywhere.

Hence, the Office is mistaken, the only polymer found in '468 is:

"....poly(styrene-ethylene-butylene-styrene)...." (SEBS) found at col. 2, lines 42-43. This polymer is a triblock copolymer of the end blocks polystyrene and midblock poly(ethylene-butylene).

Clearly, "polyethylene and polystyrene" or poly(ethylene-styrene) copolymer or (ethylene-styrene) copolymer are not found anywhere in '468 or '708 .

The Office is mistaken, the only polymers found in '708 are SEBS:

The copolymer "...poly(styrene-ethylene-butylene-styrene)...." (SEBS) found at col. 2, lines 13-14 is a triblock copolymer of the end blocks polystyrene and midblock poly(ethylene-butylene). Clearly, this is not the same resin or copolymer of "polyethylene and polystyrene", not the same copolymer poly(ethylene-styrene) or (ethylene-styrene) copolymer. Also described in '708 at col. 6, lines 27-34 are polymers of (SBS) styrene-butadiene-styrene block copolymers, (SIS) styrene-isoprene-styrene block copolymers, (low styrene content SEBS) styrene-ethylene-butylene-styrene block copolymers, (SEP) styrene-ethylene-propylene block copolymers, (SB)_n styrene-butadiene and (SEB)_n, (SEBS)_n, (SEP)_n, (SI)_n styrene-isoprene multi-arm, branched, and star shaped copolymers. Clearly, these are not resins or copolymers of "polyethylene and polystyrene" and not the same copolymer poly(ethylene-styrene) or (ethylene-styrene) copolymer.. Other polymers are mentioned in '708, these include homopolymers of polystyrene, polybutylene, polyethylene, polypropylene. These are also not resins of "polyethylene and polystyrene" found anywhere in '468 or '708.

Applicant requests the Office to indicate by column and line numbers as to where in the '468 and '708 patents are resins based on polyethylene and polystyrene are to be found, where (1) poly(ethylene-styrene) resins or polymers are to be found, or where (ethylene-styrene) polymers are to be found. The amorphous (SEBS) and (SEP)_n gels of '468 and '708 are not the same as the crystal gels of the claimed invention. Moreover, Applicant request the Office to indicate by column and line numbers as to where in the '468 and '708 patents where (2) "crystal gel" is to be found. Applicant request the Office to indicate by column and line numbers as to where in the '468 and '708 patents where (3) "polymers having "crystalline poly(ethylene) components" is to be found. Applicant request the Office to indicate by column and line numbers as to where in the '468 and '708 patents where (4) improve "properties of tear resistance and resistance to fatigue greater than amorphous gel of SEBS and SEPS" is to be found. Applicant request the Office to indicate by column and line numbers as to where in the '468 and '708 patents where (5) "crystallinity DSC values" is to be found. One or more of (1) thru (5) aspects and features are not taught explicitly, not taught impliedly, and not inherently present in '468 and '708.

Therefore, the rejection under 35 USC § 102(b) as anticipated by '468 or '708 of claims 1-14 should be withdrawn given the fact the present claims reciting one or more patentably distinguishable features and aspects not found but in the claimed invention.

The present claimed invention is non-obvious over '468 and '708 because there is nothing in the teachings of '468 and '708 to meet the instant claims 1-14, no suggestion, no showing, no description, and no reason given. Moreover, '468 and '708 can not even be modified to meet the instant claims 1-14.

The claimed invention is not based on selection of preferred parameters such as ratio of components. What is missing from the amorphous SEBS gels of '468 and '708 is the missing component of (-ethylene-) crystallinity in the copolymers altogether. If the ethylene crystallinity did not exist in '468 or '708, why, how, and for what reason would or could a non-existent parameter be selected in the first place. The components of the patented invention and the claimed crystal gel invention are not the same and the unexpected resultant improved properties of the claimed invention are not the same with respect to the inferior priorities of the amorphous gels of '468 and '708.

The patentably distinguishable differences (1) thru (5) mentioned above are not found in '468 and '708. At col. 3, line 5-6 of '468, "A is a crystalline polymer end block segment of polystyrene", the word "crystalline" is a typographical error which Applicant did not catch prior to issue. As further down at lines 10 and 11 indicate, the polystyrene segment consists of sub-micron domains of glassy polystyrene.

Both '468 and '708 do not teach the claimed crystal gels of the invention which crystal gels comprises polymers having ethylene crystallinity as stated in Applicant specification at page 8 and 9: 

"In order to obtain elastic crystal gels of the invention, it is necessary that the selective synthesis of butadiene produce sufficient amounts of 1,4 poly(butadiene) that on hydrogenation can exhibit "crystallinity" in the midblocks. In order for the block copolymers forming the crystal gels of the invention to exhibit crystallinity, the crystalline midblock segments must contain long runs of -CH₂- groups. There should be approximately at least 16 units of -(CH₂)- in sequence for crystallinity.

Only the -(CH₂)⁴ units can crystallize, and then only if there are at least 4 units of -(CH₂)⁴ in sequence; alternatively, the polyethylene units are denoted by $[-(CH_2-CH_2-CH_2-CH_2-)]^4$, $[-(CH_2-)_4]^4$ or $-(CH_2-)^{16}$. The amount of -(CH₂)¹⁶ units forming the (E) midblocks of the block copolymers comprising the crystal gels of the invention should be at least about 20% which amount is capable of exhibiting a melting endotherm in differential scanning calorimeter (DCS) curves.

Advantageously, the elastomer midblock segment should have a crystallinity of at least about 20% of -(CH₂)¹⁶ units of the total mole % forming the midblocks of the block copolymer, more

advantageously at least about 25%, still more advantageously at least about 30%, especially advantageously at least about 40% and especially more advantageously at least about 50% and higher. Broadly, the crystallinity of the midblocks should range from at least about 20% to about 60%, less broadly from at least about 18% to about 65%, and still less broadly from at least 22% to about 70%.

The melting endotherm in DSC curves of the crystalline block copolymers comprising at least 20% crystallinity are much higher than conventional amorphous block copolymers. The maximum in the endotherm curves of the crystalline block copolymers occurs at about 400C, but can range from greater than about 250C to about 600C and higher. The crystalline block copolymers forming the crystal gels of the invention can exhibit melting endotherms (as shown by DSC) of about 250C to about 750C and higher. More specific melting endotherm values of the crystalline midblock block copolymers include: about 280C, 290C, 300C, 310C, 320C, 330C, 340C, 350C, 360C, 370C, 380C, 390C, 400C, 410C, 420C, 430C, 440C, 450C, 460C, 470C, 480C, 490C, 500C, 510C, 520C, 530C, 540C, 550C, 560C, 570C, 580C, 590C, 600C, 610C, 620C, 630C, 640C, 650C, 660C, 670C, 680C, 690C, 700C, 710C, 720C, 730C, 740C, 750C, 760C, 770C, 780C, 790C, 800C, 900C, 1000C, 1100C, 1200C, and higher, whereas, the melting endotherm (DSC) for conventional amorphous midblock segment block copolymers are about 100C and lower.”

Contrary at page 6 and 7 of the specification Legge's teaches the development of (conventional substantially amorphous elastomer midsegment) SEBS triblock copolymers. In the polymerization of butadiene by alkyl lithium initiators, 1,4-addition or 1,2-addition polymers, mixtures, can be obtained. In forming styrene butadiene triblock copolymers involving the addition of solvating agents such as ethers just before the final styrene charge is added, any excess of ethers can alter the polybutadiene structure from a 1,4-cis or trans structure to a 1,2- or 3,4-addition polymer. Using difunctional coupling agent would give linear block copolymers and multifunctional agents would give star-shaped or radial block copolymers. Hydrogenation of the 1,4-polybutadiene structure yields polyethylene, while that of the 1,2-polybutadiene yields polybutylene. The resulting polyethylene will be essentially identical with linear, high-density polyethylene with a melting point, Tm, of about 1360C. Hydrogenation of 1,2-polybutadiene would yield atactic poly(1-butene) (polybutylene). The Tg of polybutylene is around -180C. Random mixtures of ethylene and butylene units in the chain would suppress crystallinity arising from polyethylene sequences. The objective for a good elastomer should be to obtain a saturated olefin elastomeric segment with the lowest possible Tg and the best elastomeric properties. Such an elastomer favored using styrene as the hard-block monomer and selecting the best monomer for hydrogenation of the elastomer midsegment.

Using a mixture of 1,4- and 1,2-polybutadiene as the base polymer for the midsegment would result in an ethylene/butylene midsegment in the final product. The elements of selection of the midsegment composition is elastomer crystallinity and the elastomer T_g of an ethylene/butylene copolymer. Very low levels of crystallinity can be achieved around 40-50% butylene concentration. The minimum in dynamic hysteresis around 35% butylene concentration in the elastomeric copolymer. A value of 40% butylene concentration in the ethylene/butylene midsegment was chosen for the S-EB-S block copolymers which are substantially amorphous; this being the SEBS triblock copolymers of '468 and '708.

Contrary, and unlike SEBS, the hydrogenation of poly(styrene-isoprene-styrene) produces poly(styrene-ethylene-propylene-styrene), SEPS, which is a completely amorphous block copolymer.

Therefore one of the patentable difference is that the copolymers if '468 and '708 are substantially amorphous comprising midblocks of (ethylene-butylene) for SEBS block copolymers and midblocks of (ethylene-propylene) for SEP_n block copolymers. Whereas, the copolymers comprises crystallites, are crystalline and produces crystal gels not amorphous gels of '468 and '708.

As noted at page 9 and 10 of the specification, the crystalline block copolymers are made by sequential block copolymer synthesis, the percentage of crystallinity or (-CH₂)¹⁶ units should be at least about (0.67)⁴ or about 20% and actual crystallinity of about 12%. For example, a selectively synthesized S-EB_n-S copolymer having a ratio of 33:67 of 1,2 and 1,4 poly(butadiene) on hydrogenation will result in a midblock with a crystallinity of (0.67)⁴ or 20%. For sake of simplicity, when n is a subscript of -EB-, n denotes the percentage of (-CH₂)₄ units, eg, n = 33 or 20% crystallinity which is the percentage of (0.67)⁴ or “(-CH₂)¹⁶” units. Thus, when n = 28 or 72% of (-CH₂)⁴ units, the % crystallinity is (0.72)⁴ or 26.87% crystallinity attributed to (-CH₂)₁₆ units, denoted by -EB₂₈-. As a matter of convention, and for purposes of this specification involving hydrogenated polybutadiene: the notation -E- denotes at least about 85% of (-CH₂)⁴ units. The notation -B- denotes at least about 70% of [-CH₂-CH(C₂H₅)-] units. The notation -EB- denotes between about 15 and 70% [-CH₂-CH(C₂H₅)-] units. The notation -EB_n- denotes n% [-CH₂-CH(C₂H₅)-] units. For hydrogenated polyisoprene: The notation -EP- denotes about at least 90% [-CH₂-CH(CH₃)-CH₂-CH₂-] units.

The differentiation between the **OLD** patented (SEBS amorphous) gels of '468 and '708 and applicant's **NEW** present (crystal gel) invention are not merely “alluded to” as suggested in the Official Action, but the differentiation and the unexpected properties are clearly stated, taught, shown, described in the specification and claimed.

Differentiated as to type of gels

Old: amorphous gel vs. New: improved crystalline or crystal gel

With respect to the amorphous SEBS gels of '468 and '708, the BACKGROUND of the present application states: "...the development of cracks or crazes resulting from a large number of deformation cycles can induce catastrophic fatigue failure of amorphous gel composites, such as tears and rips between the surfaces of the amorphous gel and substrates or at the interfaces of interlocking material(s) and amorphous gel. Consequently, such amorphous gels made from SEPS and SEBS are inadequate for the most demanding applications involving endurance at high stress and strain levels over an extended period of time." At page 5, lines 11 of the specification: "The EB copolymer midblock of conventional SEBS is almost totally amorphous and the EP midblock of SEPS is amorphous and non-crystalline."

Differentiated as to better unexpected properties due to the extra "-E- s"

OLD: inferior properties vs. NEW: improved properties

The SUMMARY of the present application states: "The crystal gels advantageously exhibit high, higher, and ever higher tear resistances than ever realized before as well as improved high tensile strength."

At page 3 of the specification under SUMMARY: "The segment (Y) of (VI) random copolymers A-Y comprises substantially crystalline poly(ethylene) (simply denoted by "-E-" or (E)). In the case of (VIII) random copolymers A-Y, (Y) may be substantially non-crystalline or amorphous ethylene segments. The midblocks (Z) comprises one or more midblocks of substantially crystalline poly(ethylene) (simply denoted by "-E- or (E)") with or without one or more amorphous midblocks of poly(butylene), poly(ethylene-butylene), poly(ethylene-propylene) or combination thereof (the amorphous midblocks are denoted by "-B- or (B)", "-EB- or (EB)", and "-EP- or (EP)" respectively or simply denoted by "-W- or (W)" when referring to one or more of the amorphous midblocks as a group) The A and Z, and A and Y portions are incompatible and form a two or more-phase system consisting of sub-micron amorphous glassy domains (A) interconnected by (Z) or (Y) chains."

In all cases of the Examples for copolymers with crystalline amounts of -E- component, the tensile strength, notched tear strength, and resistance to fatigue are found to be unexpectedly greater than that of amorphous gels of SEBS and SEPS.



Differentiated as to unexpected DSC endotherms

OLD: low vs. NEW: high

At page 9, 3rd paragraph of the specification: The melting endotherm in DSC curves of the crystalline block copolymers comprising at least 20% crystallinity are much higher than conventional amorphous block copolymers. The maximum in the endotherm curves of the crystalline block copolymers occurs at about 400°C, but can range from greater than about 250°C to about 600°C and higher. The crystalline block copolymers forming the crystal gels of the invention can exhibit melting endotherms (as shown by DSC) of about 250°C to about 750°C and higher. More specific melting endotherm values of the crystalline midblock block copolymers include: about 280°C, 290°C, 300°C, 310°C, 320°C, 330°C, 340°C, 350°C, 360°C, 370°C, 380°C, 390°C, 400°C, 410°C, 420°C, 430°C, 440°C, 450°C, 460°C, 470°C, 480°C, 490°C, 500°C, 510°C, 520°C, 530°C, 540°C, 550°C, 560°C, 570°C, 580°C, 590°C, 600°C, 610°C, 620°C, 630°C, 640°C, 650°C, 660°C, 670°C, 680°C, 690°C, 700°C, 710°C, 720°C, 730°C, 740°C, 750°C, 760°C, 770°C, 780°C, 790°C, 800°C, 900°C, 1000°C, 1100°C, 1200°C, and higher, whereas, the melting endotherm (DSC) for conventional amorphous midblock segment block copolymers are about 100°C and lower.

Differentiated as to unexpected tear characteristics

OLD: low strength smooth tears vs. NEW: high strength produce knotty tears

At page 10 bottom paragraph of the present specification states: "Because of the (E) midblocks, the crystal gels of the invention exhibit different physical characteristics and improvements over substantially amorphous gels including damage tolerance, improved crack propagation resistance, improved tear resistance producing knotty tears as opposed to smooth tears, crystalline melting point of at least 280°C, improved resistance to fatigue, higher hysteresis, etc." Tear strength is determined by propagating a tear as measured at 180° U bend around a 5.0 mm diameter mandrel attached to a spring scale.

At page 15, line 22 of the specification: "As an example, when fabric interlocked or saturated with amorphous S-EB-S gels (gel composites) are used as gel liners for lower limb or above the knee prosthesis to reduce pain over pressure areas and give relief to the amputee, the commonly used amorphous gels forming the liners can tear or rip apart during marathon race walk after 50-70 miles. In extended use, the amorphous gels can rip on the bottom of the liner in normal racewalk training of 40-60 miles over a six weeks period. In such demanding applications, the crystal gels are especially advantageous and is found to have greater tear resistance and resistance to fatigue resulting from a large number of deformation cycles than amorphous gels."

Differentiated as to stated unexpected properties
OLD: amorphous gel articles vs. NEW: crystal gel articles

At page 26, line 10: "The crystal gel articles molded from the instant crystal gels have additional important advantages in that they end-use performance properties are greater than amorphous S-EB-S gels in that they are more resistant to cracking, tearing, crazing or rupture in flexural, tension, compression, or other deforming conditions of use."

In support of applicant's position in the last response, applicant provided citation of Patents with respect to SEBS, SEPS, SEP/EBS and EP/EB gels to show the level of understanding of those of ordinary skill in the gel art being "not predictable" at the time of applicant's invention. The patents are present to show not only differentiation between gels made from amorphous SEBS copolymers and that of crystalline copolymers forming the crystal gels of the present claimed invention, but also the non-obvious of applicant's invention, the level of understanding of the ordinary skilled. For that reason, those citations are again present below:

The Office is directed to US Patent document AN (of IDS 8/27/96) #4716183 ('183). Patent '183 at col. 1, lines 24-36 regarding SEBS gels and states:

"Various compositions within this class of elastomers have different combinations of physical properties.... The particular combinations of properties.... is not predictable.... Other factors can produce drastic changes in properties of the final composition."

In further support of non-obvious, the Office is directed to US Patent document U (of IDS 10/23/97) #5618882 ('882) which states at col. 1, line 27-28:

"The SEPS gels.... Have higher tack than the known SEBS gels...." With respect to SEPS as compared to SEP/EBS gels, the '882 patent states at col 5. Lines 64-65 "Tensile strength and elongation show a general improvement, especially for EP/EB midblocks." With respect to SEPS and SEBS gels as compared to SEP/EBS gels, Col 7, Table III and lines 21-22, "....set is improved, particularly with EB/EB mid blocks...." With respect to improved phase stability of (EP/EB) midblock gels, at col. 7, lines 25-27, "...EP/EB mid block gels show a clear improvement over EB mid block gels."

According to US Patent #5618882, SEP/EBS gels show improvement in properties over SEBS and SEPS. The claimed crystal gels of the instant invention are different, patentably distinct, and non-obvious over the SEBS gel and composites of the Applicant's patented '708 and '646 SEBS and SEPS gels.

Since the unexpected properties of the claimed invention reciting ethylene crystallinity not found in any prior art and said claimed gels having a selected amount of crystallinity sufficient to achieve improvements in one or more properties including improved tear resistance and improved resistance to fatigue and the improvements in properties of the claimed crystal gel being greater than an amorphous gels made from poly(styrene-ethylene-butylene-styrene) or poly(styrene-ethylene-propylene-styrene) having substantially non-crystalline components at corresponding said gel rigidity as recited in the claims, the rejection under 102 and 103(a) being unpatentable should be withdrawn.

Enclosed are copies sheet 1 A-I, U (US5994450 appears to be relevant) obtained off the internet by applicant from 10/8/99 through 1/2000; no hard copies are available. Copies of sheets 2-8 of Form PTO 1449 sent to Applicant by a third party requesting reexamination of US Patent No. 5633286. Apparently the documents are considered of higher relevance by the third party and for that reason should also be considered by the Office with respect to this application. Also submitted are sheets 6-8 of Form 1449. The documents CA-DW, DX-FL, G-J, and FM-FY cited are cumulative fined on 8/8/96 in the parent case 08/719,817 (FB US5618882 appears to be relevant). Hard copies of all the documents were filed in 08/719,817 with Examiner Peter Szekey of Art Unit 1511.

It should be noted that Applicant's earlier filing date with respect to the SEEPS polymers dates back to PCT/US94/04278 filed 4/19/94, PCT/US94/07314 filed 6/27/94, and US Patent No. 5633286 filed 8/11/94 which priority dates are earlier than the 5618882 patent's §371 and §102(e) dates of November 14, 1994 and earlier than the US59944450 priority filing dates. Therefore, US5994450 does not appear to be relevant prior art and supports novelty and non-obviousness of the claimed invention.

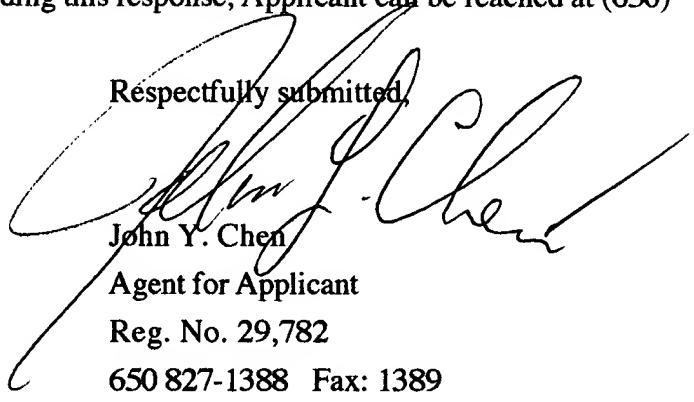
Since all the documents submitted on Forms 1449 are cumulative because the citations are from U.S. Patent #5,633,286 which is the great grand parent (three times removed) of the present application. The hard copies are as of today at Art Unit 1651 (located physically in the building across the street from Art Unit 1714) in the allow reexamination file of the '286 case.

In view of the bulk, should Examiner still want hard copies of the citations, applicant will be able to sent it under separate cover. Applicant will call Examiner to find out if the hard copies are still required.

Examiner's attention is directed to applicant's copending applications USSN: 08/719,817; 08/863,794; and 09/230,940 which the present application is a C-I-P. These applications are directed to crystalline or crystal gels like the present claimed invention but of varying scope which applications have been allowed.

Should Examiner have any questions regarding this response, Applicant can be reached at (650) 827-1388.

Respectfully submitted,


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